(54) Title: METHOD AND APPARATUS FOR SELECTIVE NETWORK ACCESS
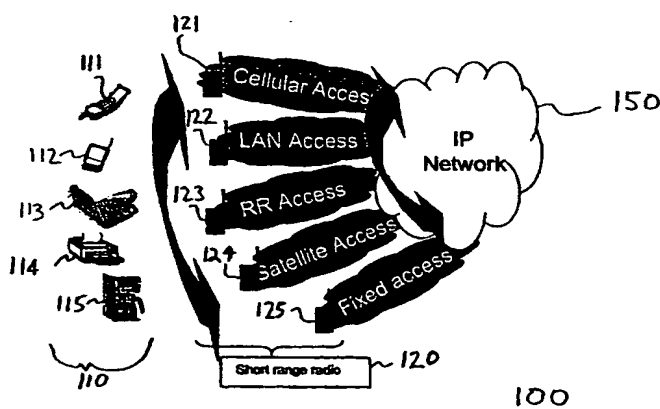
(57) Abstract: A method and apparatus for providing selective access to a network, between an end device and a network such as the Internet through one or more access network terminating devices includes determining an access capability for each access network terminating device and comparing the access capability with a preferred access capability associated with a user preference. Best access is determined based on a comparison of the capabilities of the access network terminating devices and the preferred capabilities. Once a match is found, one of the access network terminating devices is selected based on the comparison and the end device is configured according to the access capability of the selected one of the access network terminating devices. Access capabilities include, for example, cost of access, coverage area, and QoS. While communicating with the network the end device continues to detect if new access network terminating devices are available. The access capability for each of the new access network terminating devices is determined and compared with the preferred access capability and/or the current access capabilities being provided to the end device. One of the new access network terminating devices can be selected based on the comparison and the end device configured according to the access capability of the new access network terminating device.

METHOD AND APPARATUS FOR SELECTIVE NETWORK ACCESS

BACKGROUND

5   The present invention relates to telecommunications and data
communications, and more particularly to a method and apparatus for providing end
devices with network access (e.g., Internet access) by selecting from a plurality of
network terminating devices and corresponding access networks.

         For connecting an end device (e.g., a phone, computer, appliance, vending
10   machine, car, etc.) to the Internet and associated networking environments in
existence today, there is a wide choice of different access mechanisms including
fixed access, cellular access, WLAN access, satellite access, and the like, which are
available to provide access to the IP network. In order to use an access mechanism,
a network terminating device is needed to connect the end device to the access
15   network and, through the access network, to the Internet. For example, a cable or
wire pair are examples of a network terminating device associated with a fixed
access network through which an end device can be connected to, e.g., the Internet.
Likewise, a cellular phone is an example of a network terminating device associated
with the cellular wireless access network, which provides another route for end
20   devices to be connected to the Internet. Yet another example is a PCMCIA card for
WLAN network access which also may be used by an end device to communicate
with the Internet. Those skilled in the art will recognize many other examples of
network terminating devices and their corresponding access networks through which
end devices may reach other networks.

25   For many end devices, it would be desirable to be able to use different access
mechanisms (i.e., network terminating devices and access networks) for different
connection situations, depending on factors including, for example, availability,
pricing, bandwidth and the like. However, many end devices are configured to use
only one type of access mechanism. For example, many personal computers can

- 2 -

only connect to the Internet via a wireline modem and the fixed telephone access network.

In order to use different access mechanisms, an end device must have a network terminating device for each access network. Therefore, for end devices such as a laptop computer, either several network terminating devices are required to be permanently installed in the laptop or network terminating devices have to be disconnected and reconnected to the laptop each time a different access mechanism is desired. A problem arises in that if network terminating devices must be disconnected and reconnected it is difficult to determine for any given point in time which access mechanism provides the best quality connection to the ultimate network of interest, e.g., the Internet.

Providing such a determination was attempted in the BARWAN project at the University of California at Berkeley. In the BARWAN project, a laptop was equipped with access mechanisms including, for example, IR, WLAN (both of which were used to access a LAN), Ricochet, CDPD and satellite interfaces. The access mechanism that could offer the best quality for the moment was used for data transfer. Since each of the access mechanisms provided different coverage, different access mechanisms were used depending on where the user was located, for example, at the office, in the car, and the like. Again, however, the difficulty with such a system is that a separate network terminating device was provided directly to the end device for each access mechanism leading to the need for additional hardware and correspondingly higher costs. Moreover, given that space and power consumption, for example, are important considerations for end devices such as cellular phones and laptops, additional disadvantages may be posed by the additional hardware required to provide a separate network terminating device for each access mechanism.

More flexibility and lower cost would be possible in such a system, particularly in a multi-user environment such as an office, where sharing of such

network terminating devices is possible. Sharing may require, for example, a wireless interface between each of the end devices and the network terminating devices, so that the network terminating devices can be "shared" among many users. In this way a user can make use of whatever access network terminating device is

5 available at a given point in time, without the need for a direct, physical connection to each network terminating device. Such an approach to sharing has been studied at the Internet Real-time Laboratory at Columbia University and was summarized in a paper entitled "Connection Sharing in an Ad Hoc Wireless Network Among Collaborating Hosts", by M. Papadopouli, and H. Schulzrinne,

10 (http://www.cs.columbia.edu/-maria/nossdav99_final.ps).

In the Columbia project, a framework for collaborating among hosts to share a limited number of network connections with each other is being contemplated. The goal is to increase a quality metric and data availability primarily by performing load balancing between different network terminating devices which might be

15 available depending on the demand from the users in the shared environment. Each access device measures the traffic that passes through it and provides that information to the end devices so that the end devices can choose the access device which is least loaded. Such a system however, may not achieve the "best" possible access for a given end device, since different types of end devices and connections

20 may have widely varying connection considerations in determining what constitutes a "best" access. For certain types of connections, available bandwidth may be a primary "best" access consideration, while for other types of connections low delay time might be paramount.

Another drawback of the system evaluated in the Columbia project is its

25 usage of collaborating hosts which provides a uniform, but rigid, access opportunity for end devices. Instead, it would be desirable to provide a more flexible system wherein different types of end devices may have different selection criteria with respect to different types of network terminating devices and access networks. For

- 4 -

example, some network terminating devices may be provided which offer access to anyone (i.e., public access points placed in airports, shopping malls, etc.), some network terminating devices may be provided which offer access to a specified group of people (i.e., employees of a particular company or participants in a

5   particular conference) and some network terminating devices may be provided which offer access only to a particular end device. In such an environment, it would be desirable to permit an end device, particularly a mobile end device, to employ more sophisticated access network selection techniques so that a user can have preferred network accesses given various access options which might be available

10   (e.g., "I want to use my own access devices whenever possible, and the cheapest public access device in all other cases").

Yet another drawback of the Columbia system is that once an end device is linked to an external network through one of the collaborating hosts, it continues to operate through that host for the duration of the connection. Even if that particular

15   host was a good choice initially, it may not always provide the best possible connection for the entire time that the link is operative.

It would be desirable, therefore, to develop a method and apparatus which provide selective and flexible connectivity to a plurality of network terminating devices to select an access mechanism which provides a best possible access for

20   each situation. Such a method and apparatus should provide access to, e.g., the Internet, without the need for a plurality of network terminating devices to be physically integrated into the end devices, and in a user friendly manner.

SUMMARY

25   To provide a flexible and adjustably optimal connection to a network, e.g., the Internet, a method and apparatus for selective access to a plurality of different access networks by end devices is disclosed. It is therefore an object of the present invention to provide a method and apparatus capable of providing selective access

for each access situation as determined by, among other things, user preferences
related to factors such as cost of service, quality of service, etc. and the capabilities
of access networks available to the end device.

In accordance with one aspect of the present invention, the foregoing and
other objects are achieved in a method and apparatus for providing selective access
to a network, for example by linking an end device to the network via an access
network using a network terminating device. The end device may (or may not)
have a direct interface usable for data and/or voice communications. The end device
is equipped with an indirect interface and uses the indirect interface to determine the
access capability for each access network which is available to the end device. The
access capabilities may include, for example, cost of access, coverage area, available
bandwidth, delay and QoS. The determined access capability for each access
network can be compared with a preferred access capability associated with the end
device, or user thereof, wherein a particular access network can be selected based on,
for example, how favorably the determined access capabilities of each access
network compare with the preferred capabilities of the end device or user.
Accordingly the preferred capabilities may also include cost of access, coverage
area, available bandwidth, delay and QoS and both the actual access network
terminating device capabilities and the preferred capabilities may include other
factors such as the network type and the like. Based on the comparison, one of the
access network terminating devices may be selected and the end device may be
configured according to the access capabilities of the selected access network
terminating device prior to connecting to the selected access network.

In accordance with a further embodiment of the present invention, the
indirect interface may be also be used during the connection between the end device
and the ultimate network to detect if new access network terminating devices are
available to the end device. If new devices are detected, an access capability
associated with each of the new access network terminating devices may be

- 6 -

determined and a comparison may be made between the determined access
capability associated with each new access network terminating device, the
capabilities associated with the currently used access network terminating device
and a preferred access capability associated with the end device. As in the previous
5   embodiment, a decision to reselect among the available access network terminating
devices is based on the comparison. If a better access for the end device is
identified, the new access network terminating device is selected and the end device
may be reconfigured according to the access capability associated with the selected
new access network terminating device.

10

BRIEF DESCRIPTION OF THE DRAWINGS

The objects and advantages of the invention will be understood by reading
the following detailed description in conjunction with the drawings, in which:

FIG. 1 is a diagram illustrating an exemplary access network environment;

15   FIG. 2 is a block diagram illustrating an exemplary indirect interface
between an end device and an access network terminating device in accordance with
an exemplary embodiment of the present invention;

FIG. 3 is a hardware block diagram illustrating an exemplary end device and
an exemplary access network terminating device in accordance with the present

20   invention; and

FIG. 4 is a flowchart illustrating exemplary steps including device discovery,
access discovery, access selection, and access configuration in accordance with the
present invention.

25   ## DETAILED DESCRIPTION

The various features of the invention will now be described with reference to
the figures, in which like parts are identified with the same reference characters. In
the following description, for purposes of explanation and not limitation, specific

- 7 -

details are set forth, such as particular circuits, circuit components, techniques, etc. in order to provide a thorough understanding of the present invention. However, it will be apparent to one skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details. In other instances,

5   detailed descriptions of well-known methods, devices, and circuits are omitted so as not to obscure the description of the present invention.

In accordance with an exemplary embodiment of the present invention it is desired therefore, to combine a plurality of access mechanisms, fixed as well as mobile, to flexibly select a "best" possible access for each situation. This should be

10   done without the need for a plurality of access network terminating devices being integrated into the end device, and in an easy way for the user.

FIG. 1 illustrates an exemplary system in which various end devices 110 are shown connected to an IP network 150, which IP network is for example the Internet or an Intranet. End devices 110 can come in many forms, for example, cellular

15   phone 111, wireless palmtop computer 112, laptop 113, printer 114, and even intelligent household devices such as coffee pot 115. Those skilled in the art will appreciate that these are just a few examples of end devices which can be used in conjunction with the present invention. Access to IP network 150 can be made through an indirect interface 120, e.g., a short range radio interface such as that

20   provided by Bluetooth technology. The interface 120 between the end devices 110 and the plurality of access network terminating devices 121-125 is referred to herein as an "indirect" interface because some of the end devices 110 may also have a direct interface for communicating with their traditional networks. For example, cellular phone 111 may have, as its direct interface, a GSM cellular interface. On the

25   other hand some end devices 110, e.g., those which do not otherwise have a communication function such as coffeepot 115, may not have a direct interface.

Indirect interface 120 may be configured to interface with terminating devices 121-125 for any one of a number of exemplary network access mechanisms

- 8 -

such as, for example, cellular access mechanism 121, LAN access mechanism 122, Ricochet access mechanism 123, satellite access mechanism 124, and fixed access mechanism 125. It is important to note that while specific access mechanisms may be described herein for exemplary purposes, it is contemplated that new access

5   mechanisms or access mechanisms not specifically enumerated are within the scope of the present invention.

As was described above, indirect interface 120 may be embodied, for example, as a short range wireless transmission system. One example of such an interface is that defined by the recently developed "Bluetooth" technology which

10   facilitates two-way data transmission. Bluetooth is a universal radio interface in the 2.45 GHz frequency band that enables portable electronic devices to connect and communicate wirelessly via short-range, ad hoc networks. Readers interested in various details regarding the Bluetooth technology are referred to the article entitled "BLUETOOTH -- The universal radio interface for ad hoc, wireless connectivity"

15   authored by Jaap Haartsen and found in the Ericsson Review, Telecommunications Technology Journal No. 3, 1998, the disclosure of which is incorporated here by reference. For the purposes of the present invention, only Bluetooth features of immediate interest are described here to avoid obscuring these exemplary embodiments. Moreover, the indirect interface 120 can be embodied using

20   interfaces other than Bluetooth interfaces.

In this application of a Bluetooth system as an indirect interface for end devices, a Bluetooth transceiver (illustrated in FIG. 3) is associated with, for example, each of the plurality of network terminating devices 121-125. The transceiver may act as a master device and continuously transmit, for example,

25   INQUIRE messages for receipt by any end device 110 that may be in the vicinity. Another Bluetooth transceiver, included in each end device 110, would respond to this transmitted message. End device 110 may then proceed through indirect interface 120 to lock on to a channel of the indirect interface 120.

- 9 -

Alternatively, the master/slave roles may be reversed and the Bluetooth transceiver of an end device 110 may send the INQUIRE messages to seek network terminating devices. Then, Bluetooth transceivers of network terminating devices within range of the end device 110 will respond to establish a Bluetooth link

5 therewith in order to exchange capability information as described below. In this way, end devices 110 need only a single e.g., Bluetooth, indirect interface 120 to select any one of the plurality of access network terminating devices that are available within reach of indirect interface 120. If end device 110 knows what kind of access network terminating devices are available, it may compare factors such as

10 cost, quality, and the like, associated with each available access network and choose the "best" one according to a selection scheme, as described in more detail below. The current values for these (and other) factors can be transmitted over the indirect interface 120 to the end device 110 for evaluation and selection.

To better understand the configuration of the fixed and mobile or remote

15 portions of indirect interface 120, reference is now made to FIG. 2 wherein a diagram illustrating an exemplary indirect interface between end device 210 and network terminating device 220 is shown. User preferences 211 may be kept in end device 210, e.g., stored in a local memory and updated by a user, and may be related to those factors (e.g. cost, QoS, and the like) considered by the user to be of greatest

20 importance in selecting which access mechanism to use for communicating data with network 150. Prior to comparing user preferences 211 with corresponding capabilities of access networks, it is first determined which access mechanism(s) are available. Access discovery protocol blocks 214 and 224 perform the polling over the indirect interface 120 described above (in either direction) to identify the

25 available access mechanisms for a particular end device 110. Thus, access discovery protocol blocks 214 and 224 also perform the initial "handshaking" needed to establish a communication link 230 between the end device 210 and the access

- 10 -

network terminating device 220, e.g., by allocating a Bluetooth channel there between.

Current information about the network access available via network terminating device 220 may be kept in information block 221, which may be stored
5   in a local memory, continuously updated, or the like. As part of the access discovery protocols performed by blocks 214 and 224, this information may be transferred to the end device 210 over link 230.

Information so obtained by end device 210 may be used for subsequent comparison to user preferences 211 in access selection step 212. When a suitable
10   match is found between user preferences 211 and access information received from information block 221 related to the access characteristics of access network terminating device 220, that terminating device (and its corresponding access network) is selected. Then, configuration may begin with configuration block 213 establishing configuration information exchange 240 with corresponding
15   configuration process 223 of access network terminating device 220.

This configuration information is used to ensure that data packets to be transmitted between end device 210 and the IP network 150 are routed correctly. For example, this configuration information can include an IP address associated with the selected access network, as well as other information, e.g., subnet, gateway,
20   DNS server information, etc. The end device 210 can receive an IP address that is valid in the selected access network, in which case the end device 210 has a direct connection to the IP network 150 and can transmit and receive data packets directly therewith.

Alternatively, the end device 210 and the network terminating device 220
25   can agree on a dummy IP address associated with their connection (i.e., an IP address that is not valid in the access network) and the connection to the IP network 150 can be made using an IP address assigned to the network terminating device 220. Those skilled in the art will appreciate that there are many techniques available

- 11 -

for configuring end device 210 and network terminating device 220 so as to provide
an IP connection, any of which may be employed herein. However, the interested
reader is directed to "The IP Network Address Translator (NAT)", IETF RFC 1631,
to K. Egevang and P. Francis, May 1994, ftp://ftp.isi.edu/in-notes/rfc1631.txt, the
5   disclosure of which is incorporated here by reference.

Alternatively, or additionally, if the network terminating device 220 and/or
its corresponding access network support Mobile IP (see, for example, "IP Mobility
Support" IETF RFC 2002, to C. Perkins, October 1996, ftp://ftp.isi.edu/in-
notes/rfc2002.txt, the disclosure of which is also incorporated here by reference), the
10   end device 210 offers a so-called foreign agent to the network terminating device
220 as part of the configuration process. Using Mobile IP in this way is particularly
advantageous in the context of the present invention since Mobile IP supports
handover between foreign agents which means that ongoing TCP connections will
not be broken if the end device 210 selects another network terminating device 220
15   during the connection.

Once end device 210 is properly configured, access may be attempted and
granted from access network terminating device 220 by an appropriate exchange
with access control block 222, which may require authorization and related
registration procedures as are known in the art for gaining access to network 150.

20   It should be noted that in, general, three steps are performed to establish a
network connection between end device 210 and, for example, network 150 as
shown in FIG. 1. First, end device 210 discovers which of the plurality of access
network terminating devices are available, then the "best" access mechanism to use
for the present moment is selected based on the type of access network terminating
25   devices found and the user's preferences, and finally configuration for the chosen
access network is performed.

An exemplary hardware block diagram is illustrated in FIG. 3 in accordance
with an exemplary embodiment of the present invention. End device 310, which

- 12 -

may correspond to any of the devices illustrated in FIG. 1 (or some other device) that has both a direct and indirect transceiver, and in the exemplary embodiment shown in FIG. 3, may be, for example, a cellular phone. End device 310 may be equipped with direct transceiver 340, and antenna 341 for conducting normal data

5   transfer using, e.g., a cellular interface having traffic and control channels in accordance with known air interface standards and cellular telephone practices. Indirect transceiver 330 with antenna 331 may form a portion of indirect interface 300 and is preferably the only interface required to connect with the network terminating devices which can be used to connect end device 310 with IP network

10   380. Processor 320 may be configured to conduct steps such as, for example, device discovery, access discovery, access selection and the collection of user preferences. User preferences may be obtained in a number of ways e.g., via voice or key input, as would be apparent to one skilled in the art and may further be stored in memory 321.

15   In network terminating device 350, which includes, for example, a fixed portion of indirect interface 300 and can be located in a mall, there will be another indirect transceiver 360 for communicating with the indirect transceiver 330 in the end device 310. The transceiver 360 may be configured to communicate via antenna 361 over an air interface to indirect transceiver 330 in end device 310 to establish

20   device discovery, access discovery, and configuration as previously described with reference to FIG. 2. Processor 370 of device 350 communicates with access mechanisms 354, which represents the various structure and/or circuitry need to interface with the access network 375. For example, if the access network 375 is a wireline, telephone network (PSTN), then the access mechanism 354 can be

25   implemented as a telephone modem. Information regarding potential access to IP network 380 via access network 375 (e.g., current available bandwidth, average BER, subscription class for which access network 375 is currently accepting connections, etc) may be obtained by processor 370 continuously or periodically via

access mechanism 354 and stored in memory 371. Although only one network terminating device 350 is illustrated in FIG. 3 to simplify the figure, it will be appreciated that, in practice, end device 310 is expected to be within range of more than one network terminating device 350 at some times.

To better understand an exemplary process by which selective access may be practiced, FIG. 4 may be referred to which illustrates an exemplary flowchart in accordance with the present invention. When an end device, such as exemplary end device 310, or any end device as illustrated in FIG. 1- FIG. 3 wants access to, for example, an IP network, it has to first find out if such access is possible based on whether there are any access network terminating devices available, such as, for example, access network terminating device 354. From start block 410, decision block 411 may represent such a process by which an end device determines whether there are any access network terminating devices present. As mentioned earlier, this may include actively polling network terminating devices by transmitting a request and/or listening for announcements that are periodically transmitted by the network terminating devices. If no network terminating devices are located, then block 412 represents a network terminating device discovery process which loops back to continue to poll or listen for network terminating devices.

If one or more network terminating devices are detected, then the end device may determine the identity of the access mechanism and associated access capabilities of the access network terminating devices as represented in block 413, based on information, such as that provided, for example, in information exchange 230 described with reference to FIG. 2. In order to ultimately select which access network terminating device(s) to use if there are several available, or to determine whether to use an access network terminating device or not if there is only one, the end device obtains information about the access network terminating device, its associated access network and their cumulative or respective access capabilities. Such information may include, for example, the cost of access, bandwidth available,

- 14 -

QoS parameters, priority level available, delay and the like as illustrated in block 414. Thus, the phrase "access capabilities" as it is used herein refers to one or more of these (and other factors) associated with the access network terminating device, its corresponding access network, both the access network terminating device and its

5   corresponding access network, or any other network components which may impact the parameter(s) of interest to the end device with respect to a potential connection with the ultimate network.

        If the network terminating devices are broadcasting announcements that indicate their presence to end devices, then these announcements may include access

10   capability information associated therewith. The announcement may include information regarding all of the access parameters of interest, or may include information regarding only a subset of the access parameters which are more commonly included in the user preferences stored in memory 321. If the announcement does not include sufficient information for the end device to make a

15   selection based upon the selection function performed by processor 320, then the end device sends another request to the network terminating device as part of step 412.

        If the kind of access mechanism provided and associated access capabilities favorably compare to that established by, for example, user preferences 211, which

20   comparison is represented in block 415, then a second comparison may be made in block 417 to determine if the present match is the best match of all available access network terminating devices. If the access mechanism does not favorably compare, then as represented by block 416, the next device, if any, is checked. In any case, all available access network terminating devices are checked until the one with the most

25   favorable comparison to user preferences 211 is found. It should be noted that the basis for comparison may be established such that even in the event that none of the available access network terminating devices exactly meets the criteria established by user preferences 211, that some selection may be made, or in the alternative one

- 15 -

of the user preferences may specify that an exact match must be made. Accordingly, the choice of how to select from available access network terminating devices will be made based on individual preferences. For example, "best" access may, for one user, be the cheapest access mechanism, or, for a different user, it might be the fastest access mechanism.

As is represented in block 419, a configuration step may be performed once a "best access" match is found in accordance with the above described procedure and the description of configuration information exchange 240 described above with reference to FIG. 2. After configuration step 419 is complete, access may be completed and communication with network 150 may begin. It should be noted that in order to ensure that the "best" access is provided continuously or nearly continuously, a periodic search may be made for available access network terminating devices as represented by step 420. Even after the end device has chosen one network terminating device to use, it can continue to look for other available network terminating devices. If a new network terminating device is a better "best access" match than the one currently used, as represented by decision block 422, the end device may reconfigure and change to the new access network terminating device as represented by block 421. A hysteresis value can be used to avoid "ping-ponging" between network terminating devices which have similar match values with respect to a particular end device's selection algorithm.

If there are more devices to check, all devices should be checked first in the event there is a better match than the present new network terminating device as represented in block 423. If no more network terminating devices are present and the present new network terminating device is not a better "best access" match, the process may be returned to block 420 to continuously look for new devices. It is to be noted that in accordance with an exemplary embodiment of the present invention, the selection of an access network terminating device should be an automatic process. Likewise, the necessary configuration needed to use the specific access

- 16 -

should also be done automatically in a manner as would be known to one skilled in the art.

The invention has been described with reference to a particular embodiment. However, it will be readily apparent to those skilled in the art that it is possible to embody the invention in specific forms other than those of the preferred embodiment described above. For example, although network access has been described in these exemplary embodiments as providing a direct path from an end device through a network terminating device and access network to an ultimate (IP) network of interest, those skilled in the art will appreciate that intermediary nodes or networks may be present.

Moreover, end devices having both a direct and indirect interface may operate as both an end device and a network terminating device. Consider that, once such an end device becomes connected to the IP network it is, itself, a termination of the linked networks. Since this connected end device is communicating with the IP network using its indirect interface, it may act as a network terminating device if its primary interface is not being used for some other purpose. Consider the foregoing example wherein the end device is a cellular phone having, as its indirect interface, a Bluetooth transceiver. If the user of the cellular phone is browsing the worldwide web using its Bluetooth transceiver, its direct (cellular) transceiver may be idle and, therefore, available for some other end device to connect with to reach the Internet. Thus, the cellular phone would also have a set of access capabilities which would reflect its ability to act as a conduit for the second end device.

Thus, it can be seen that these exemplary embodiments are merely illustrative and should not be considered restrictive in any way. The scope of the invention is given by the appended claims, rather than the preceding description, and all variations and equivalents which fall within the range of the claims are intended to be embraced therein.

WHAT IS CLAIMED IS:

1.   A method of selectively accessing a network, using an end device having an indirect interface that can communicate with one or more access network

5   terminating devices, the method comprising the steps of:

determining an access capability for each of the one or more access network terminating devices; and

comparing the determined access capability for the each of the one or more access network terminating devices with a preferred access capability

10   associated with the end device, wherein at least one of the access network terminating devices is selected based on the comparison.

2.   The method of claim 1, further comprising the step of:

configuring the end device according to the access capability of the

15   selected at least one of the one or more access network terminating devices.

3.   The method of claim 1, wherein the access capability further includes one or more of: cost of access, coverage area, bandwidth, delay, priority level and QoS.

20

4.   The method of claim 1, wherein the preferred access capability further includes one or more of: cost of access, coverage area, bandwidth, delay, priority level and QoS.

25   5.   The method of claim 1, further comprising the steps of:

polling the indirect interface to detect if one or more new access network terminating devices are available to the end device;

- 18 -

determining an access capability for each of the one or more new access network terminating devices if detected; and

comparing the determined access capability for the each of the one or more detected new access network terminating devices with at least one of said
5   preferred access capability associated with the end device and said access capability of a currently used access network terminating device, wherein one of said new access network terminating devices can be selected based on the comparison.

6.   The method of claim 5, further comprising the steps of:
10   selecting one of the one or more new access network terminating devices based on the comparison; and

configuring the end device according the access capability of the selected one of the one or more new access network terminating devices.

15   7.   A system for providing selective access to a network comprising:
an end device;

at least one access network terminating device for connecting said end device to said network; and

an indirect interface coupled to the end device and to said at least one
20   access network terminating device, the indirect interface configured to:
determine an access capability for each of the at least one access network terminating device; and

compare the determined access capability for the each of the at least one access network terminating device with a preferred access capability associated
25   with the end device, wherein one of said at least one access network terminating devices is selected based on the comparison.

8.   The system of claim 7, further comprising:

- 19 -

means for configuring the end device according the access capability of the selected one of the at least one access network terminating device.

9. The system of claim 7, wherein the access capability further includes one or more of: cost of access, coverage area, and QoS.

10. The system of claim 7, wherein the preferred access capability further includes one or more of: cost of access, coverage area, and QoS.

11. The system of claim 8, further comprising:
means for polling to detect if one or more new access network terminating devices are available to the end device;
means for determining an access capability for each of the one or more new access network terminating devices if detected; and
means for comparing the determined access capability for the each of the one or more detected new access network terminating devices with at least one of said preferred access capability associated with the end device and an access capability of a currently employed access network terminating device, wherein one of said new access network terminating devices can be selected based on the comparison.

12. The system of claim 11, further comprising:
means for configuring the end device according to the access capability of the selected one of the one or more new access network terminating devices.

13. The system of claim 8, wherein said end device is a cellular telephone.

- 20 -

14.   The system of claim 13, wherein said cellular telephone includes, as a direct interface, means for communicating over a cellular air interface and includes, as said indirect interface, means for communicating over a Bluetooth air interface.

5   15.   An end device comprising:
                means for storing access network preferences;
                means for communicating with a plurality of network access terminating devices over a indirect interface;
                means for selecting one of said plurality of network access
10   terminating devices by receiving access network capabilities associated with each of said plurality of network access terminating devices over said indirect interface and comparing said received access network capabilities with said stored access network preferences.

15   16.   The end device of claim 15, wherein said indirect interface is a Bluetooth interface.

17.   The end device of claim 15, wherein said access network terminating devices provide a communication link with the Internet.
20

18.   The end device of claim 15, further comprising:
                mean for communicating over a direct interface.

19.   The end device of claim 18, wherein said end device can
25   communicate simultaneously over said direct interface and said indirect interface.

20.   The end device of claim 18, wherein said direct interface is a cellular interface.

21.   A method for selectively connecting an end device to a network comprising the steps of:

identifying at least one network terminating device available to said end device for connection to said network;

5   transferring capability information between said at least one network and said end device;

comparing said transferred capability information with stored user preferred capability information;

selecting one of said at least one network terminating device based on

10   a result of said comparing step; and

connecting to said network using said selected network terminating device.

22.   The method of claim 21, further comprising the step of:

15   continuing, after said connecting step, to identify network terminating devices available to said end device.

23.   The method of claim 22, further comprising the step of:

determining if capability information associated with a newly

20   identified network terminating device provides a greater match with said stored user preferred capability information than said selected network terminating device.
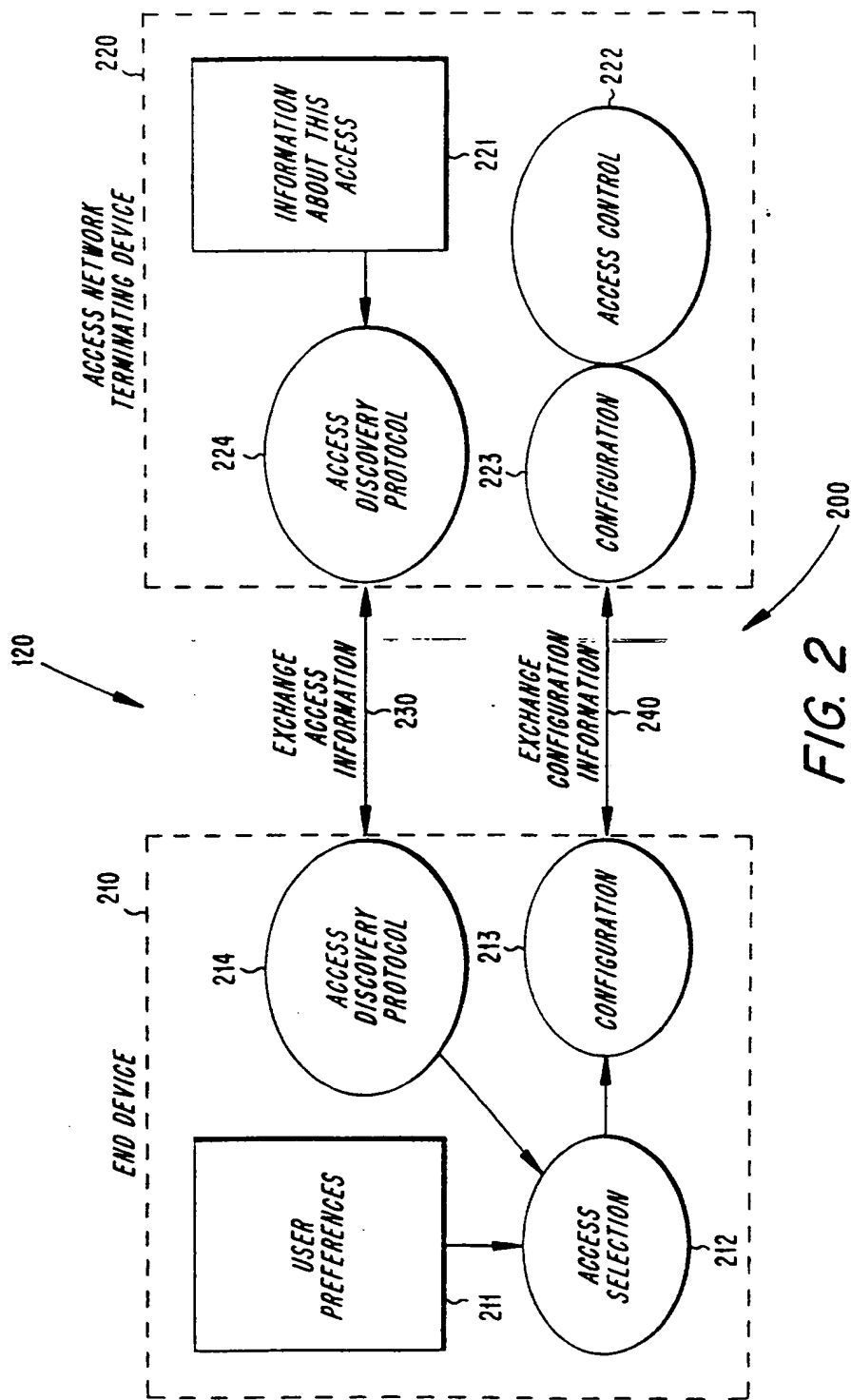
24.   The method of claim 23 further comprising the step of:

selectively changing said connection to said network from said

25   selected network terminating device to said newly identified network terminating device based on a result of said determining step.

- 22 -

25.   The method of claim 21, wherein said step of transferring further comprises the step of:

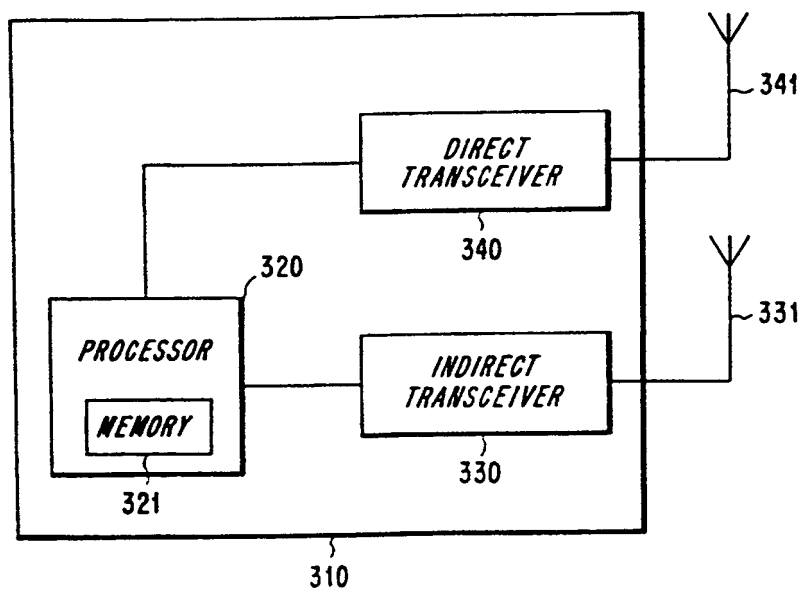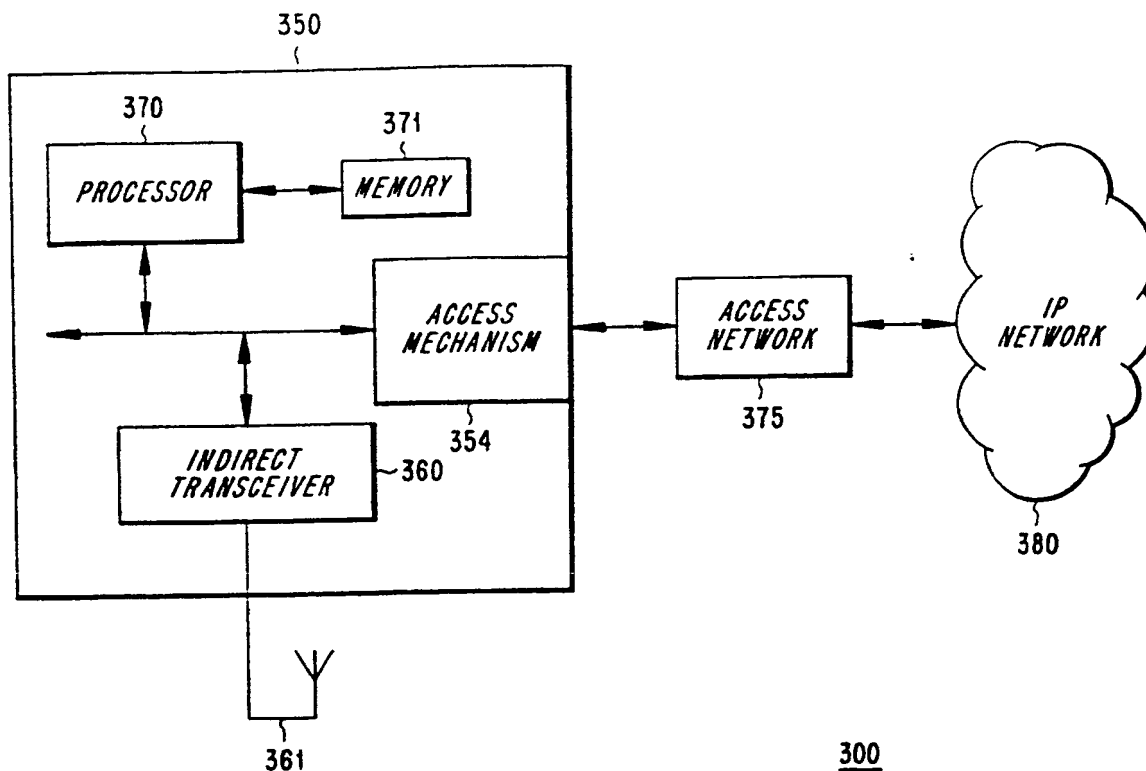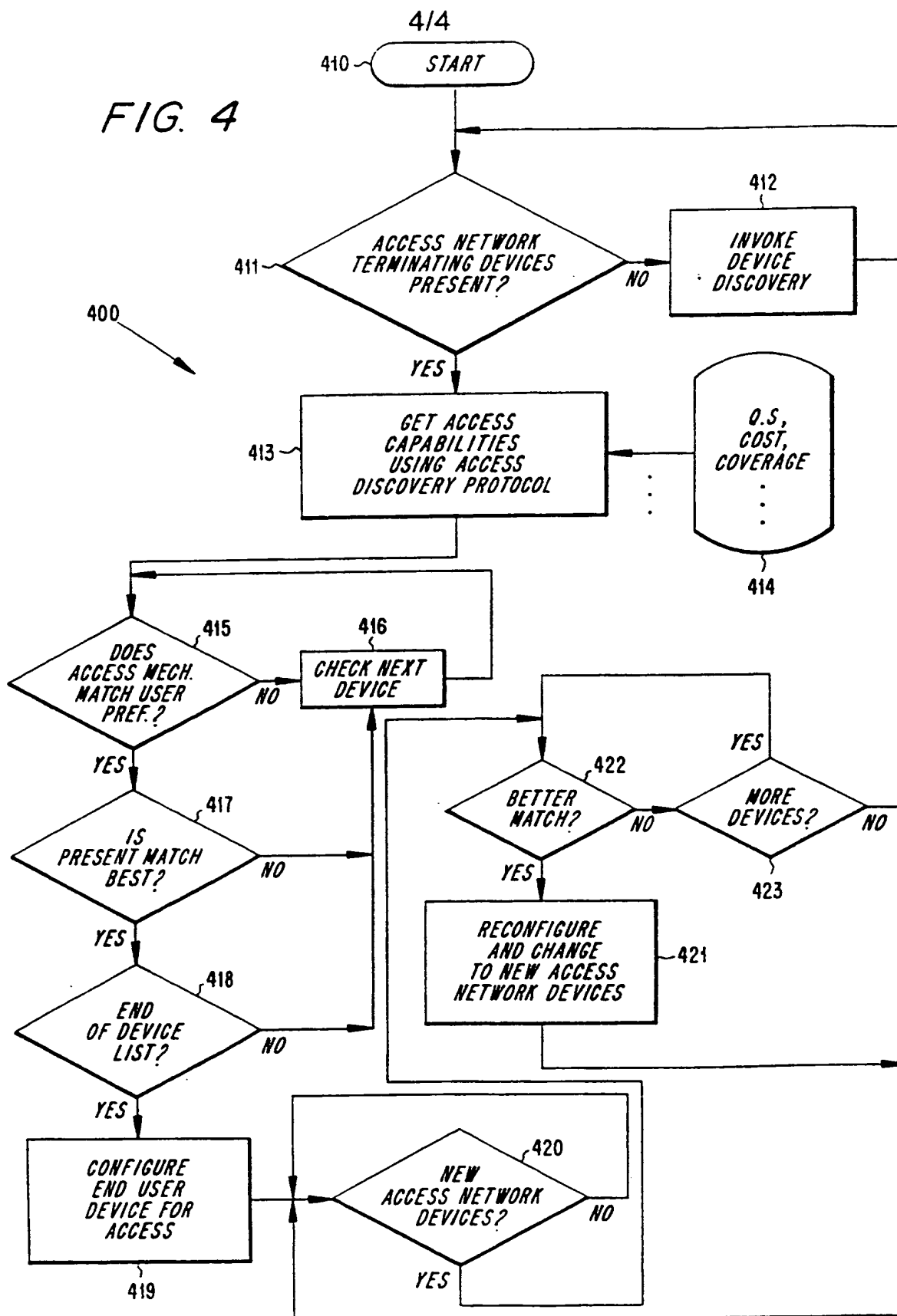offering, from said at least one network terminating device, a foreign agent to said end device.

FIG. 1
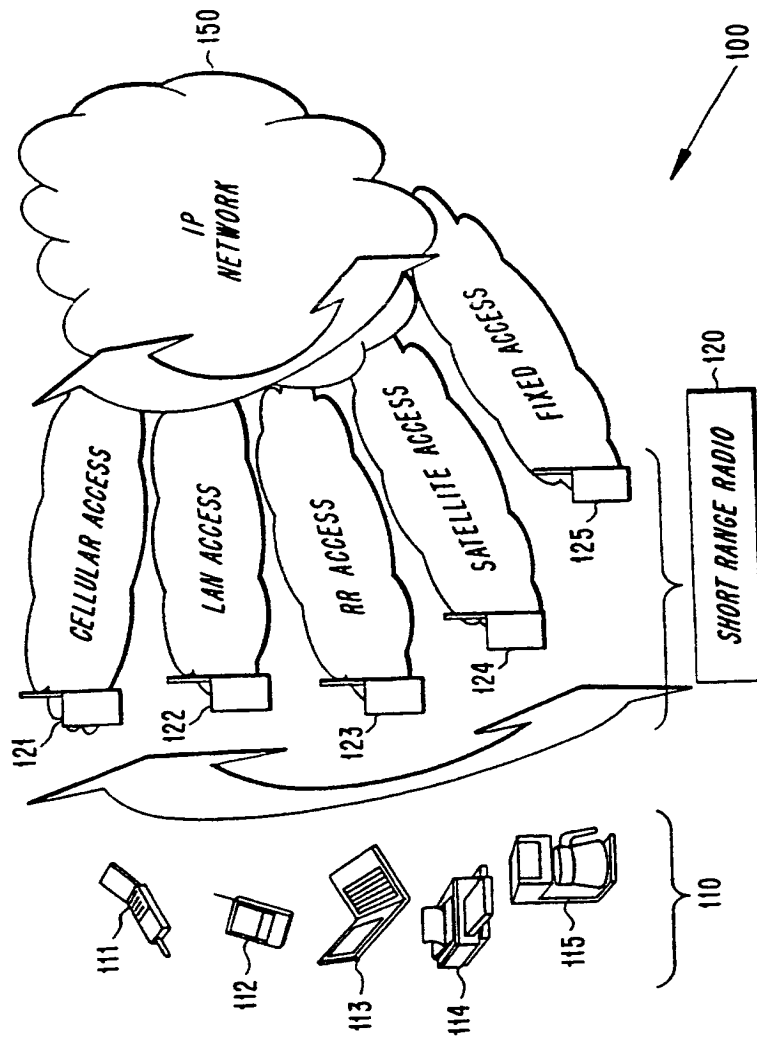
FIG. 2

350

370

PROCESSOR

371

MEMORY

ACCESS
MECHANISM

354

INDIRECT
TRANSCEIVER

360

ACCESS
NETWORK

375

IP
NETWORK

380

361

300

341

DIRECT
TRANSCEIVER

340

320

331

PROCESSOR

MEMORY

321

INDIRECT
TRANSCEIVER

330

310

FIG. 3

4/4

FIG. 4

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7   H04L12/56   H04L29/06   H04L12/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7   H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 97 40638 A (LIND PATRIC ;TELIA AB PUBL (SE)) 30 October 1997 (1997-10-30) abstract page 1, line 31 -page 2, line 14 page 3, line 28 -page 4, line 8 page 4, line 32 -page 6, line 10 page 8, line 13 - line 32 --- <center>-/--</center>	1,7,15, 21

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 January 2001	19/01/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office. P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340-2040. Tx. 31 651 epo nl. Fax: (+31–70) 340-3016	Larcinese, C

Form PCT/ISA/210 (second sheet) (July 1992)

	Inten nal Application No
	PCT/SE 00/02110

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
Y	ALBRECHT M ET AL: "IP Services over Bluetooth: leading the way to a new mobility" PROCEEDINGS OF THE CONFERENCE ON LOCAL COMPUTER NETWORKS, October 1999 (1999-10), pages 2-11, XP002130784 page 2, left-hand column, line 26 -right-hand column, line 33 page 4, left-hand column, line 8 - line 31 page 4, right-hand column, line 47 -page 5, right-hand column, line 10 page 6, right-hand column, line 17 - line 44 page 7, right-hand column, line 14 -page 8, left-hand column, line 11 ---	1,7,15, 21
A	GB 2 294 844 A (MOTOROLA INC) 8 May 1996 (1996-05-08) abstract page 3, line 22 -page 4, line 3 page 4, line 20 - line 25 -----	1-25

1

INTERNATIONAL SEARCH REPORT

. ..ormation on patent family members

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
WO 9740638	A	30-10-1997	EP	0894410 A	03-02-1999
			NO	984869 A	22-10-1998
			SE	9601559 A	25-10-1997
GB 2294844	A	08-05-1996	AU	700136 B	24-12-1998
			AU	3980095 A	31-05-1996
			CN	1141111 A	22-01-1997
			DE	19581443 T	27-02-1997
			WO	9614719 A	17-05-1996
			FI	962789 A	03-09-1996
			JP	9507986 T	12-08-1997

THIS PAGE BLANK (USPTO)